THRUSTING A DIFFERENT FUTURE

REGULUS electric propulsion module IoD in UniSat-7 mission

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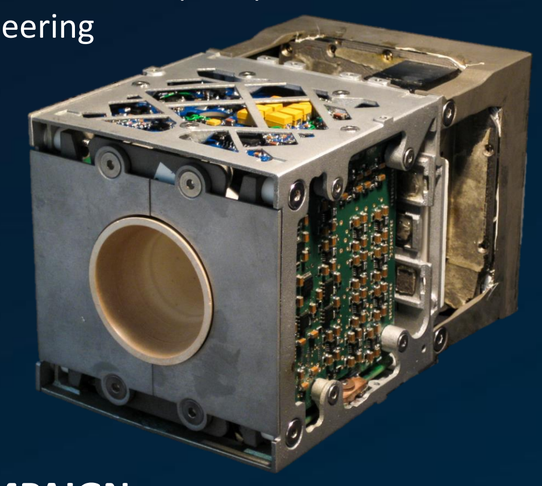
THE COMPANY:

T4i is a propulsion system company founded in 2014, originated from the Space Propulsion Group of University of Padua, Italy, and active in the market of small satellites. In the last decade T4i has been developing REGULUS, a cutting-edge electric propulsion system for in-space mobility fed with iodine propellant. REGULUS has been specifically designed for Cubesats and micro satellite platforms and it is based on a RF Magnetically Enhanced Plasma (MEP) thruster.
Thanks to its standard interfaces it is conceived to be easily "plugged&played" into the satellite, without complex engineering procedures.
Its In-Orbit Demonstration will take place in Q2/Q3 2020 onboard UniSat-7, a microsatellite of the Italian company GAUSS.

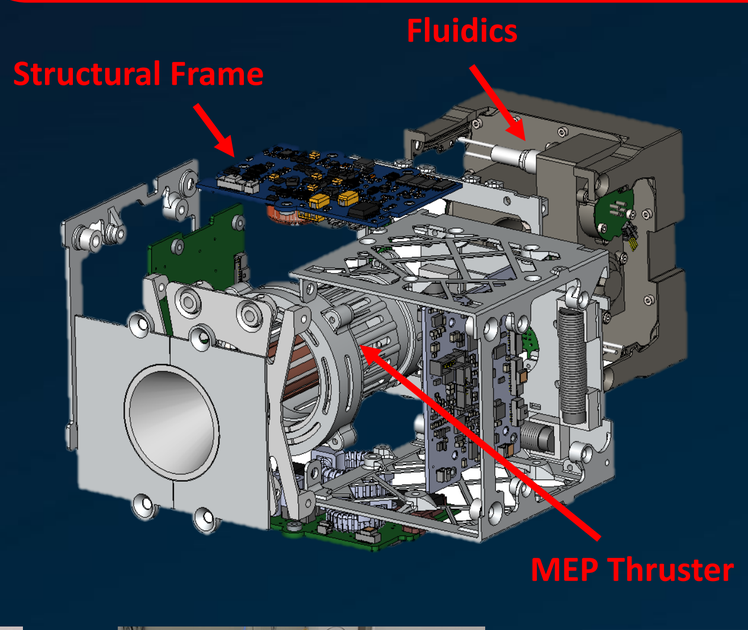


THE TECHNOLOGY:

Thrust	0.6 mN @50W (0.25-0.7) mN
Specific Impulse	600 s @ 50 W (up to 700 s)
Total Impulse	3000-11000 (up to unlimited) Ns
Required power	50 W (range 20-60 W)
Mass flow	0.1 mg/s
Propellant	Solid Iodine (I2)
Volume 1U = (10x10x10cm)	1,5 U @ 3000 Ns 2 U @ 11000 Ns
Weight	2.5 kg @ 3000 Ns

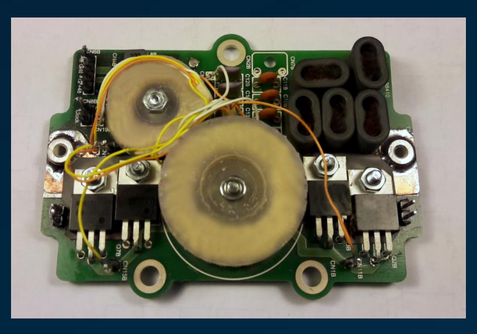
MAIN COMPONENTS AND CHARACTERISTICS

- › Discharge Chamber
- › RF antenna
- › Magnetic System
- › Feeding system
- › No Electrodes
- › No Neutralizer
- › No Erosion
- › Multiple gases

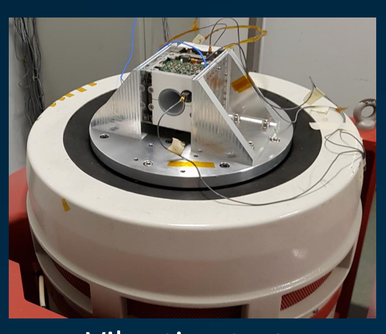


TEST CAMPAIGN:

REGULUS QM version has been successfully tested in vibration with qualification levels at the facilities of University of Padua, and the same version is being tested in thermal-vacuum in the TVAC chamber owned by T4i.
The configuration is more than a classical structural-thermal model, since the fluidics and the motor sub-systems are in the final version (all sensors and valves up and running, tank full of propellant).
REGULUS will be qualified as well at the facilities of the European Space Agency in autumn 2019.



In-house built miniaturized PPU



Vibration test

Thruster

Test with Xenon propellant

APPLICATIONS:

REGULUS is versatile and allows new and so far unexplored mission scenarios able to enlarge satellites' life-time period and efficiency, such as:

- satellite positioning (in-track and cross-track maneuvers such as orbit raising, decommissioning, inclination change)
- satellite station keeping (drag compensation at low orbits, orbit phasing, formation flying, continue or periodical operations)
- cubesat carriers positioning

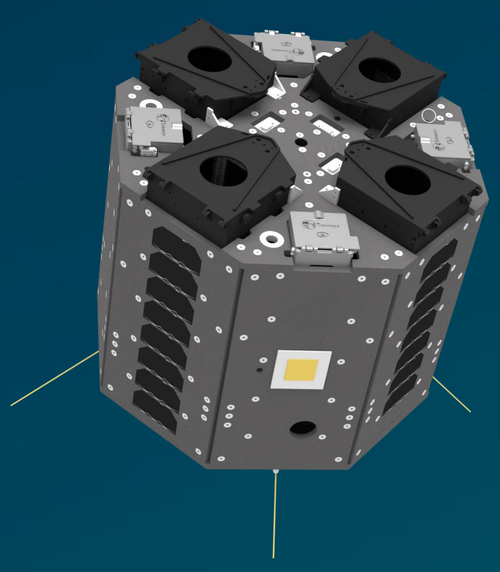
	Orbital changes	CubeSat decommissioning	Drag Compensation
REGULUS-A Configuration	6U orbital changes for a total of 500 km altitude in 1.7 month overall	6U decommissioning from 750 km altitude in 1.6 month	- 6U 3 years life guaranteed @ 300 km - 6U > 5 years life guaranteed @ 350 km
REGULUS-B Configuration	12U orbital changes for a total of 950 km altitude in 6 months overall	- 12U from 1200 km altitude in 6.0 months - Decommissioning is guaranteed from higher altitudes	- 12U > 6 years life guaranteed @ 300 km
	Still propellant onboard for formation flying and/or decommissioning	*Natural orbital decay of 1 month considered @350 km*	*Without compensating propulsion:* - *1U 21.6 days @ 300 km*

GAUSS:

Gauss Srl is an italian company based in Rome, born in 2012 as a spin-off of the Scuola di Ingegneria Aerospaziale of the La Sapienza University. Back in 2000 the company gave life to the UniSat satellites serie that work both as launcher platforms and as carriers of fixed payloads.

UniSat-7

UniSat-7 is a small satellite of 32 kg and a micro-platform that hosts several CubeSats and PocketQubes onboard, and deploys them through GAUSS CubeSat Deployer system GPOD once reached the final orbit. The satellite features a unique system called **GAUSS-ARS** (*GAUSS Automatic Release System),* that automatically controls the opening of the satellite deployers, with several redundant and safety measures to provide a fail-safe approach to satellite orbital deployments.



ORBIT DETAILS:

- Launch vehicle: Soyuz-2, Russia
- Launch base: Baikonur or Vostochny
- Launch period: Q2/Q3 2020
- Orbit type: Circular, Sun-Synchronous
- Orbit altitude: ≈ 600 km
- LTAN: 11:00 am
- Orbital Period: 97' (= 5820'')
- Orbital Eccentricity: ≈ 0.005
- Max moment of inertia with CubeSats: ≈ 1.3 Kg m2

The partnership with T4i will enable the platform to perform several orbital control maneuvers, like the adjustment of the orbital height. This feature will be essential for the next step in GAUSS orbital deployment technology: providing a safe and efficient access to space for CubeSat constellations, and allowing to shape relative geometries between deployed CubeSats by using T4i's Regulus thrust capabilities along with GAUSS' AOCS and deployment system.

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Find out more about us at:
www.t4innovation.com